Name: _____ Date: _____

PRACTICE 112m / 4 sec 9.1

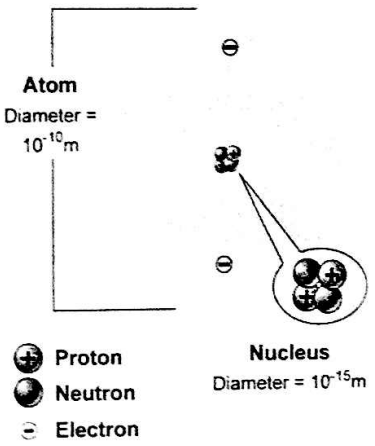
The Structure of the Atom

READ

Atoms are made of three tiny subatomic particles: protons, neutrons, and electrons. The protons and neutrons are grouped together in the nucleus, which is at the center of the atom. The chart below compares electrons, protons, and neutrons in terms of charge and mass.

	Occurrence	Charge	Mass (g)
Electron	found outside of nucleus	-1	9.109×10^{-28}
Proton	found in all nuclei	+1	1.673×10^{-24}
Neutron	found in almost all nuclei (exception: most H nuclei)	0	1.675×10^{-24}

Size and Structure of the Atom



The **atomic number** of an element is the number of protons in the nucleus of every atom of that element.

Isotopes are atoms of the same element that have different numbers of neutrons. The number of protons in isotopes of an element is the same.

The **mass number** of an isotope tells you the number of protons plus the number of neutrons.

Mass number = number of protons + number of neutrons

The **atomic mass** of an element is based on the mass numbers of the elements isotopes. For example, a standard table of elements lists an atomic mass of 6.94 for the element lithium. That does NOT mean there are 3 protons and 3.94 neutrons in a lithium atom! On average, 94 percent of lithium atoms are lithium-7 and 6 percent are lithium-6 (Figure 9.10). The average atomic mass of lithium is 6.94 because of the weighted average of the mixture of isotope.

EXAMPLES

Carbon has three isotopes: carbon-12, carbon-13, and carbon-14. The atomic number of carbon is 6. The atomic mass of carbon, 12.0111 amu.

a. How many protons are in the nucleus of a carbon atom?	**Answer:** 6 protons; the atomic number indicates how many protons are in the nucleus of an atom.
b. How many neutrons are in the nucleus of a carbon-13 atom?	**Answer:** 7 neutrons the mass number - the atomic number = the number of neutrons 13 – 6 = 7
c. Which of the carbon isotopes is most abundant in nature?	**Answer:** At atomic mass (12.0111 amu) is based on the mass number and abundance of each of the carbon isotopes. Because the mass number is close to the whole number "12," we can assume that the most abundant isotope of carbon is carbon-12 (whose mass number is 12).

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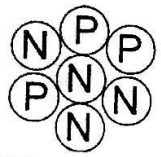
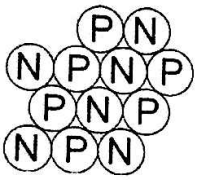
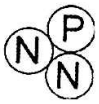
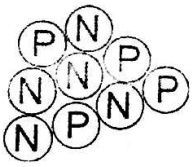
PRACTICE

Use a periodic table of the elements to answer these questions.

1. The following graphics represent the nuclei of atoms. Using a periodic table of elements, fill in the table.

What the nucleus looks like	What is this element?	How many electrons does the neutral atom have?	What is the mass number?
			
			
			
			

2. Look at a periodic table. The atomic mass of hydrogen is 1.00794. Why is this number not rounded off to 1?

3. How many protons and neutrons are in the nucleus of each isotope?
   a. hydrogen-2 (atomic number = 1)
   b. scandium-45 (atomic number = 21)
   c. aluminum-27 (atomic number = 13)
   d. uranium-235 (atomic number = 92)
   e. carbon-12 (atomic number = 6)

4. Although electrons have mass, they are not considered in determining the mass number or atomic mass of an atom. Why?

5. A hydrogen atom has one proton, two neutrons, and no electrons. Is this atom neutrally charged? Explain your answer.

6. An atom of sodium-23 (atomic number = 11) has a positive charge of +1. Given this information, how many electrons does it have? How many protons and neutrons does this atom have?